Geo-Portal and Metadata Registry Plan
Prepared for the
Alaska Geospatial Council

November 19, 2014

PROLOGUE

1994 marked a sea change in the handling of geospatial information. That year two international organizations were stood up to address the challenges of geospatial interoperability: the Open Geospatial Consortium and ISO Technical Committee 211 (TC/211). For twenty years now, these two organizations have been setting and updating standards for geospatial information in a cooperative manner, deriving elements from one another over the entire period. OGC is an international member based organization, with the members being largely private organizations from the industry or having geospatial needs; government agencies with significant geospatial functions; and universities with strong programs in geography, GIS, remote sensing, or other geospatial technologies. TC/211, as an ISO Technical Committee, is composed of representatives from national members and liaison groups, with a very structured process for developing and approving standards. OGC, as a member driven organization, has greater flexibility in terms of processes, and used their nimbleness to advance their standards at a reasonably rapid pace. In combination a number of needs have been met through the combined efforts of these two organizations. They have recognized the needs of multiple networks; variable user demands for both connected and disconnected users; the need for authority and maintenance of datasets; and the ability to describe, catalog, and discover both data and services.

It is the combined vision of the two organizations that is most significant. Striving for interoperability for geospatial information systems and data, they designed standards which address a range of challenges, from specific descriptions of what are very detailed and complex data structures to the means to present information to end users in a variety of ways meeting a range of needs. In the context of Alaska, this philosophy is particularly relevant. Alaska presents a set of challenges which are usually only encountered by organizations with international information gathering and dissemination needs.

A final note in the early years of these organizations, they were dealing with the concept of Distributed Computing Environments. In 1994, the World Wide Web was just coming into mainstream view. In 2001, when OGC conducted the first Open Location Services (OpenLS) testbed, the first generation smart phone was two years away, and the touch interface modern smart phone was not even a concept for most people, including technology savvy individuals. Today, the Cloud and mobile technologies will have deep effects on the design of a GeoPortal for the State of Alaska and its ultimate implementation.

INTRODUCTION

The Alaska Geospatial Council (AGC) has been conducting research into the design and implementation of a GeoPortal which would serve the various needs of a range of stakeholders within the State and of partners, collaborators, and others outside of the State. The GeoPoratal will be a single user access point for discovering and accessing geospatial data, services and applications for the state of Alaska. The AGC has expressed an interest in pursuing ISO metadata in support of this initiative. This interest has been interpreted to mean practically the ISO 191xx series of standards, and in particular to mean the ISO 19115 and 19139 set of geospatial metadata standards. While the State's requirements will be delineated in detail in a subsequent section of this document, the key considerations are as follows:

- A GeoPortal with the ability to host both geospatial data and metadata provided by a variety of contributing organizations, using geospatial services and applications
- A capacity to describe both online and offline data holdings
- A capacity to support both online and offline users and devices
- A capacity to work in the de facto world of the Cloud, but to house critical data in Alaska in preparation for an emergency which might sever communications to the contiguous United States
- A capability to access data held by authoritative sources in the environment of their organization
- Variable access levels for publishers, authorized users, and general users
- Flexibility to adapt to changing technologies and future needs

A number of ancillary issues which fall largely into the area of policy as opposed to technology come into play. It is anticipated certain license or otherwise restricted data may be hosted or referenced by the GeoPortal. The technology solutions to address this are well understood and addressed well by the market. The nature of the policy is a matter for the AGC and its participating organizations to resolve, thus, this document does not address these policy questions, but does address the related technical design.

Some key concepts to understand.

- A well-known format is one that is either widely used in industry or one that is defined by a recognized body; examples would include ShapeFiles, GeoPDF, GeoTIFF, File or Personal Geodatabases, .IMG, KML,
- A well-known service is one that is provided by a widely used industry technology (e.g., ArcGIS Online, Google Maps, ERDAS Apollo, etc.) or adheres to a standard that is defined by a recognized body (OGC WMS, WFS, WCS, etc.)
- The client computing environment is complex with clients devices ranging from desktop/laptop personal computers to tablets to smart phones to dedicated geospatial data devices
- There is a wide range of potential users the GeoPortal might serve
    - GIS Professionals
    - Professionals from other disciplines with a need for geospatial information
    - Decision-makers who do not necessarily have great familiarity with geospatial data or systems
    - Representatives of organizations with ongoing or ad hoc needs to use geospatial data
    - Members of the general public

REQUIREMENTS

There are three primary sources of requirements for the Geo-Portal and Metadata Registry Plan. Those are the Alaska SDMI Geo-Portal and Metadata Registry task order request (TOR), the Stakeholder Survey results, and the interviews with Key Officials. For organizational purposes this plan will draw initially on the TOR to form the baseline requirement, then use the findings from the survey and interviews to elaborate on the requirement.

CONNECTIVITY

The GeoPortal needs to provide means for users with bandwidth constraints to be able to access and obtain data. The nature of bandwidth constraints are primarily viewed to be a result of users who live or work in rural areas with limited internet infrastructure or to be a result of users who are working in remote areas of the State where there is either little or no internet infrastructure. The survey and interviews addressed this point.

According to the survey results, over 61% of the respondents were connecting from a rural or remote area sometimes or always to access geospatial data. Such users pursue a number of strategies to connect to the internet. As Figure 1 shows, this results in some users being disadvantaged in terms of available bandwidth. Furthermore the results would indicate some users would have issues with either maintaining a stable bandwidth (cellular users) or stable connections (commercial internet satellite signal can be disrupted by weather). The clear requirement is to provide a variety of users with a range of connectivity situations with a means to access geospatial information. This raises the first crucial question in the design. The first OGC testbed and the resulting Web Mapping Service were created to meet just such a requirement which is to provide information to users without burdening them with the overhead of downloading or streaming a massive dataset. The critical point was providing information does not require one to provide direct access to data, particularly in terms of allowing data to be downloaded.

Requirement 1: Provide access to visualize geospatial information through a lower bandwidth connection

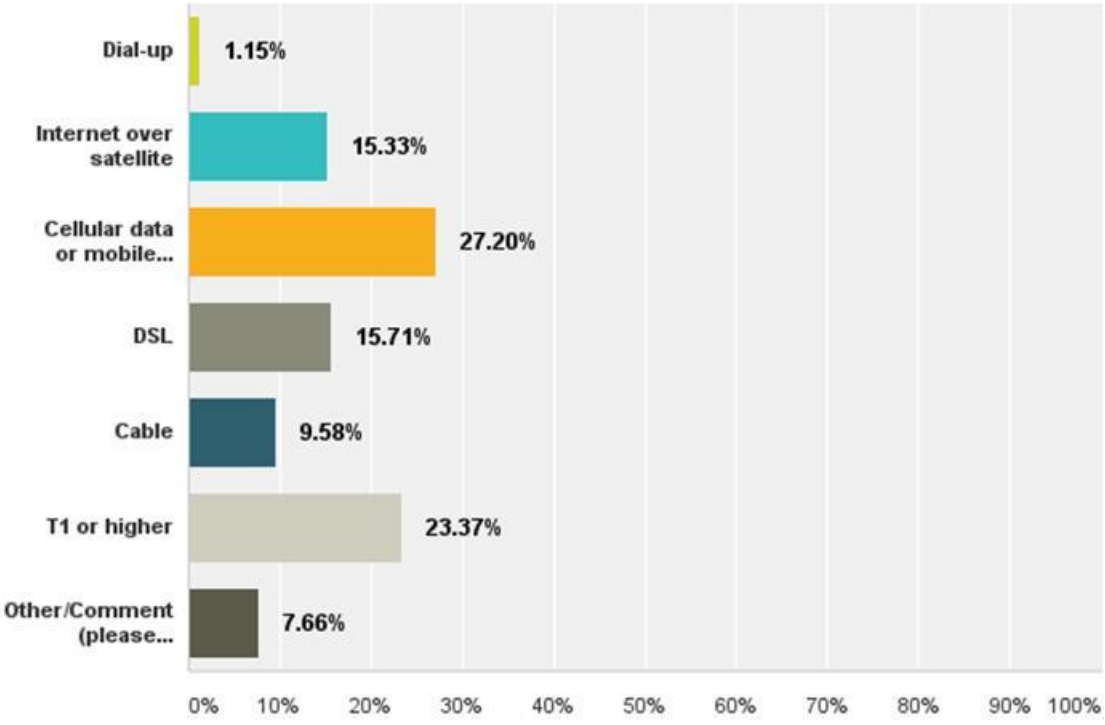

Figure 1: Users in rural and remote settings access the internet in a number of ways.

The challenge to this method is when users become disconnected they are unable to retain the information. This necessitates either a means to cache the map images from the service or to download data for consumption by an application which can work offline. The first option means users will need to define the extent of their information needs prior to becoming disconnected. While the data burden will be relatively light, few applications are designed to work in this capacity, although thick client GIS tools such as ArcGIS or GeoMedia are able to do this. There are many applications that can deal with downloaded geospatial packaged in a well-known format.

Requirement 2: The GeoPortal shall allow the downloading of map images from web map services to a client application.

The necessity which arises from downloading geospatial data packaged in a well-known format for the user with constrained bandwidth is to obtain only the necessary information and thus limit the amount of data downloaded. Since a user may want to download data only for a limited area, the means to identify the area and obtain the required data must be provided.

Requirement 3: The GeoPortal shall allow the selection of an area of interest (AOI), the means to save data from the selected area of interest in a well-known file format, and the means to download the resulting file to a client device (commonly known as clip, zip, and ship).

This puts a burden on the end user to have the necessary software to open the data file, but that is a reasonable presumption. As in most computational matters, even where there are interoperable solutions, the user's experience will vary depending on particular variables with their hardware, operating system, software (both in terms of the product and the version of the product, and infrastructure (networking and other factors).

Finally a user may want to obtain an entire dataset. It is highly probably such a situation will exceed reasonable performance parameters of the GeoPortal. There would be some upper limit both technically and policy-wise which will encumber general system performance beyond normal expectations (an example of such a burden is when a large file or set of data exceeding a volume such as 1 TB is moved across a network with the result that system limitations are exceeded and the network fails). Attempting to download whole datasets may mean the system is attempting to cope with a download of over 1 TB, which likely will affect overall system performance.

Requirement 4: The metadata should describe how to access and obtain large datasets by means other than conventional HTTP or FTP techniques.

This requirement must be tempered by policy pertaining to restricted datasets. While key officials of agencies holding restricted datasets were willing to allow the GeoPortal to publish "fact of" metadata describing such holdings, they were not willing to make those available for direct access. Consequently it is reasonable to assume even "fact of" metadata may not provide details pertaining to access of such databases, but provide contact information for further inquiries via defined channels.

It will require a policy decision(s) by the AGC and its partners to determine the practical means of obtaining entire datasets whether provided or referenced on the GeoPortal. Technically there are myriad means to do this.

Typically, in such instances at least some users would anticipate providing updates to the geospatial information held on the GeoPortal. Again, this requires establishing policy which defines the process by which this would be allowed and accomplished. Again, from a technology point of view, there are various means which could be used to reintegrate data into the holding. In essence there are several use cases that describe the various processes required which will be discussed later in this paper.

SUSTAINABILITY AND FUNDING

The questions related to sustainability which were presented in both the 2014 AGC survey and the key officials interviews led to a variety of views. While the great consensus was the State should create a GeoPortal, definitions of what it means to do so varied. This reflected differences of understanding of what a GeoPortal (or portal in general) is. Regardless, there was agreement by the vast majority of players that having such a resource would be beneficial to the state and to the organizations the respondents represented. Their views of funding the GeoPortal depended much on the representative constituency. The survey responses mostly came from representatives of government organizations from Federal to State to Local and/or Tribal (in response to Question

3). Other government related users came from the military or educational institutions. While some identified as "other", these individuals could clearly be associated with one of the choices provided. 22.25% of the respondents indicated they were either representing a private or a non-profit organization. The data suggests only one respondent self-identified as representing the public. Thus the complete audience of respondents can be understood to be a very motivated by their practical needs in governance or business. In this instance, governance

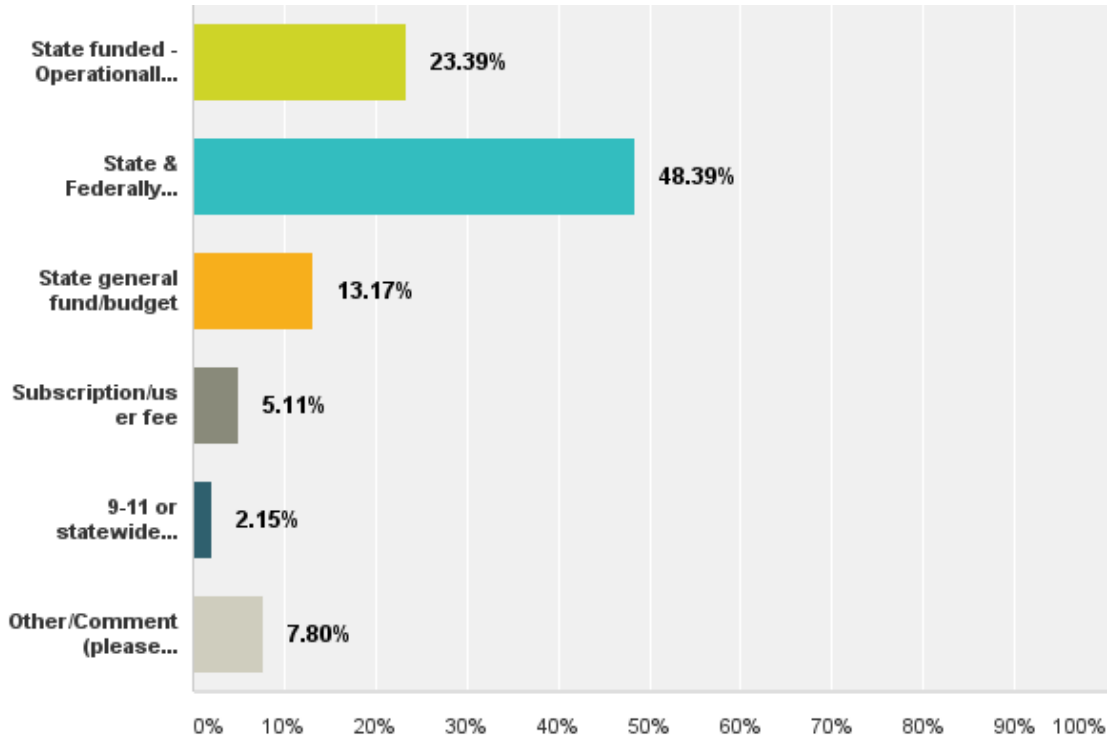

Figure 2: Survey respondent's views on funding the GeoPortal varied. 372 answered this question and 22 skipped.

as a term includes government operated institutions such as education and military operations.

Views on funding methodologies varied with no majority view being held. Drawing from the interviews first, the representatives of Federal agencies abstained from addressing this question, either due to lack of authority to commit or recommend budget policy, or the opinion that such recommendations fell outside of their purview. The survey responses indicated a major plurality thought the GeoPortal should be funded by a combination of State and Federal funds. Another lesser plurality suggested it be funded by the State through a State agency, and the third most significant view was that it be funded by a State general budget line item. In the key officials interviews State and local government representatives tended to agree with the hybrid Federal/State funding model, believing it should be a line item in either level of government's budget. Additionally these key officials gravitated towards the view that a single State agency should administer the GeoPortal from a curation perspective. The representatives of the University of Alaska-Fairbanks took a slightly variant position based on their experience hosting GINA; their view was significant Federal funding would be a result of partnerships and specific project funding. They emphasized the need to pursue such partnerships in order to preserve existing activities and value, and to respect the existence of previously created relationships of this nature.

A specific question about sustainability was presented to data publishers who might provide data to the GeoPortal. They were asked about the minimal period of funding they would need before they would be willing to invest into moving data and providing compliant data to the GeoPortal. Simply put they would want no less than three years of sustained funding, and some would want to be assured upwards of seven years of funding would be provided to maintain the GeoPortal. A similar question was posed to the Key Officials. Their response was more flexible, with some taking a viewpoint that their engagement was critical to launching the GeoPortal and ensuring its sustainability. However they did realize its success would depend on a reasonable period of sustained funding, in the 3-7 year range.

Requirement 5: Funding should be committed for a period of 3-7 years through a State level line item in a State agency budget at the minimum

NO FEE ACCESS TO PUBLIC DOMAIN DATA

The participants in the Survey who are currently providing Public Domain data by other means remain committed to continuing the practice. The advent of the GeoPortal is viewed as another means or in some cases a replacement means to continue to provide the same data. There is concern among the various agencies represented in the interview process to make any licensing of data as non-onerous as possible, with the majority view being towards some form of sunsetting clauses wherein use restrictions are lifted after a period of time. An alternative view which was raised in addition proposed better negotiations be conducted to allow for more openness of licensed data.

Requirement 6: The GeoPortal should be designed in a way allowing for ease of republishing no fee Public Domain data from current holdings or to document via metadata a means to easily link to and access data which remains in current holdings from the GeoPortal

PROTECTING LIMITED USE DATA

There are datasets being held by agencies at all levels of government and other institutions which could be described as sensitive, thus requiring restrictions on how it is released. The nature of risks associated with such data vary from endangerment of the public to endangerment of cultural and environmental resources. The agencies which have responsibility to protect this data take their stewardship very seriously, and their current practices reflect this fact. The Bureau of Land Management (BLM) holds sensitive archaeological site data. They withhold these data from access, although they are willing to provide metadata to describe the "fact of" such holdings. In such cases, this approach is entirely reasonable, because access to such data is not critical for most users or in most circumstances. Consequently, it is lower risk simply not to make the data directly accessible via the GeoPortal through any authentication means. In most foreseeable situations, actual need for such data can be projected, and requests can be made through formal channels which can be adjudicated. Should access be granted, there are numerous conventional means other than the GeoPortal for providing the required data access.

The previous example represents one extreme; there are sensitive data which require greater access. The needs can be described by the matrix in Table 1. Simply put, access to sensitive data needs to be understood in terms of dual risk analysis. There is risk associated with releasing the data to unauthorized users. There is also risk in not releasing these data to authorized users in circumstances where the public safety is in jeopardy in a time sensitive situation. Table 1 uses some real-world examples to illustrate this principle. In essence the table addresses both the risk of unauthorized users accessing data and then the risk of authorized users *not* having access.

Table 1: Dual Risk Analysis							
Factor	**Initial Risk**	**Probability**	**Impact**	**Secondary Risk**	**Probability**	**Impact**	**Restriction**
Archaeological Sites	Site molestation and damage	Moderate; factors like ease of access, motivation, and perceived value come into play	Variable; some sites are protected by the "security of obscurity" ; others may have stronger security; however substantial loss or damage could occur and irreparable harm incurred	Reasonable research and education may be prevented	Low; current channels are probably sufficient for adjudicating access to data	Low; there are existing means to investigate such sites	Keeping this data offline and only advertising "fact of" informs those with legitimate need for access and provides them means to do so
Gas mains	These represent potential terror targets; public safety and well being are threatened by unauthorized access	Low; such instances are rare and targets are selected for messaging impact; however a target may be deemed as convenient and effective by perpetrators	High; a detonation may lead to loss of life, limb, and property; it may also lead to loss of vital services for an unforeseen period of time	Multiple; accidental disruption leading to endangerment of the public; emergency response being hindered, limitation to provision of other services	High; such incidents occur reasonably frequently and new construction always increases the probability	Moderate to high; a detonation may lead to loss of life, limb, and property; disruption of services; delay of economic activity	This data should be held in a secure, but accessible manner; an authorization policy would need to be established; two factor or higher security measure should be used
e911 EMS responses	Potential violation of personal privacy	Low, such data might be collected to understand use patterns for resource management; it might be released for some perceived political or gains	Moderate; privacy violations and possible resulting litigation; political risk is high	Planning might be limited; such data would be only of limited use to certain authorities in terms of resource planning	Low: channels other than use of the GeoPortal are viable	Low; data can be abstracted and analyzed by other means	The exposure of data could result in litigation and political turmoil; it would be better to keep it off the portal
Event Security	These also represent terrorist targets and are attractive as such (e.g., Boston Marathon bombing)	Low; such instances are rare and targets are selected for messaging impact; however a target may be deemed as convenient and effective by perpetrators	High; an attack may lead to loss of life, limb, and property; it may also lead to loss of vital services for an unforeseen period of time	Multi-agency security cooperation might be disrupted thus increasing public risk	High; events of this nature occur routinely, are well known, and easy targets; as such agencies need to share data to most effectively protect the public	High; as has been shown by recent incidents the occurrence is highly damaging to both public safety and ongoing governance	Data of this nature must be secure but accessible; authorization policies must be in effect to limit access to authorities

The examples in Table 1 represent a number of risk types. The exploitation of data for many reasons must be recognized as a real and ongoing threat. Data leaks of people's financial data and other private data is one most people recognize. But the release of data for political reasons is also a real risk as evidenced by State of New York citizens who held gun permits for handguns having their addresses published on a map on a journalism website, with the data obtained from government records. The threats to safety and privacy are too high with some datasets so it is necessary to provide levels of security to ensure only those who are authorized have access. It is also useful to track who actually accesses data of this nature in a manner which is reasonably tamper-proof.

Recent incursions into data holdings clearly indicate the age of the password is waning quickly. Restricted data holdings on the GeoPortal need to be minimally secured by two-factor authentication. The ability to use cell phones and other means such as security code tokens to receive one time second factor codes is an inexpensive means to provide such security. Access needs to be logged in a permanent fashion to ensure data security.

The nature of security measures is changing. The advent of near field commerce systems such as Apple Pay which mean no identifying information is stored on a device, and that information exchanges are based on a one-time use code, means new methods for securing information are being developed and these are inherently more secure than traditional username and passwords combinations. The Apple Pay system, as an example, uses a biometric means (*e.g.*, fingerprints etc.) to limit access to data and the system.

Requirement 7: The GeoPortal should require dual factor authorization to restricted datasets deemed to be highly useful to authorized users for pre-approved uses

Requirement 8: The GeoPortal should allow the publishing of "fact of" metadata to describe restricted datasets that are deemed to be best protected by not providing direct access data access via the portal and which are consequently kept offline

Requirement 9: The GeoPortal should require all accesses to restricted data be logged in a tamper resistant manner to show the user, IP address, date, and timestamp; additionally any data edits, prints, report generation, or exports should be logged

IDENTIFYING DATASETS FOR STATE LICENSE UPLIFTS

The first principle which should inform the identification of datasets that would be included in a statewide license uplift is common need among multiple agencies. For example, the market response indicates road network data and processing is common to an enormous segment of the population. It is offered as a free commodity on the internet and a bundled capability with smart phones. It has even been leveraged by a crowd-sourced open data project. This is the first criteria. The second principle is currency of the data. Another form which is provided as a commodity is relatively high resolution imagery (sub-meter). However this data tends to be dated and is not useful for situations where conditions have changed, particularly when those changes are acute. However near-current imagery is of potentially high value as it will allow for an evaluation of circumstances affecting phenomena of concern in the present. The third principle is ease of acquisition. The road network data previously mentioned is a good example of an aspect of this idea; such data can be accurately acquired through multiple technologies with relatively low acquisition costs. It is also relatively static, which enables easy acquisition, since changes are the focal area of collection. In contrast, imagery of vegetative conditions can be more difficult to acquire. Weather can interfere in many ways, whether the consideration is cloud cover, moisture conditions (including rain), sun angle, and other factors. Because such conditions are far more dynamic, and collection windows are often short, such data may be considered more difficult and costly to collect. Accuracy and other factors in processing the data may also make it difficult to acquire. Acute situations are an even more extreme variant of this theme. A final principle is urgency. In an urgent situation, licensed data may be the quickest way to get results. Consequently a conceptual algorithm for identifying datasets for state uplift licenses would account for all four of those factors. So a candidate would meet the following criteria:

- Multiple agencies in the various affected levels of government have need for the data
- The data is current and of value for understanding present conditions and the nature of acute changes
- The data is very challenging to acquire thus rendering it non-commodity and possibly unique
- There is some discernable urgency to acquiring the data

The IfSAR data currently being collected for the state is a good example to evaluate with these principles. Multiple agencies clearly benefit from accurate topographic data which is both positionally and vertically more precise than any other existing data. The data is current and should be useful for understanding acute changes. It is difficult to acquire and processing is an intensive process rendering the data unique at its resolution and spatial extent. Aviation safety represents at least one urgent need for the data.

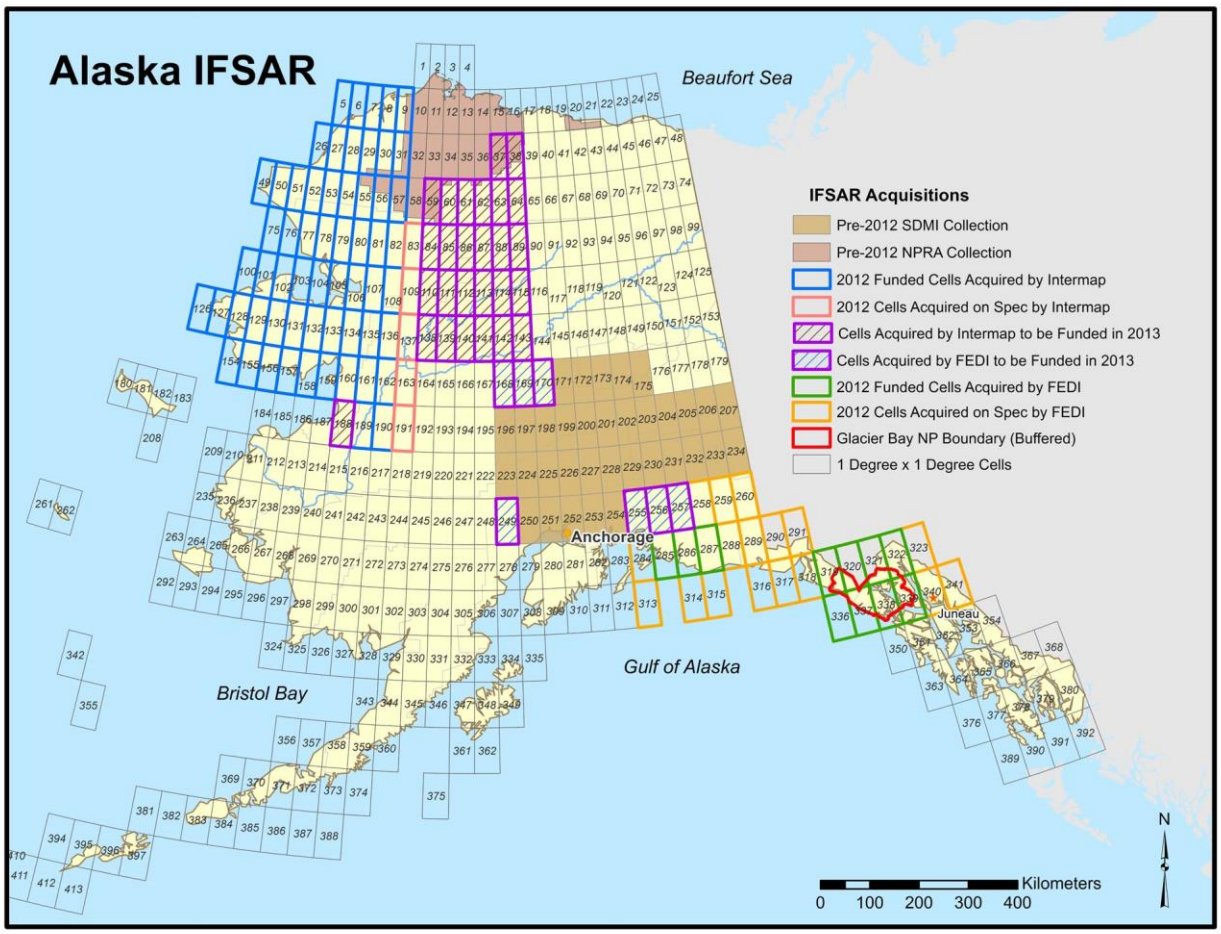

Figure 3: The Alaska IfSAR data is an example of a dataset that met multiple criteria for providing data without a license to the State.

Requirement 10: The GeoPortal should provide a tool for multiple stakeholders to provide an assessment of their need for licensed data thus allowing the State of Alaska to evaluate the probable value of uplifting a data license for statewide use.

DEFINING STATEWIDE LICENSING POLICY AND PROCEDURE

We recommend a *data-as-a-service* (DaaS) model to ensure the State has the most current, relevant and freely accessible imagery and/or elevation data for their needs. Data Providers would enter into an agreement to provide state relevant datasets such as imagery and/or LiDAR data and provide a web based portal for accessing DaaS within a Cloud platform. Unlike other DaaS models this model does not propose to limit the use of the data through licensing agreements. The intent is for both public sector and private industry to have available a rich data source for various applications, including oil and gas exploration, urban planning, energy infrastructure, hazards

mitigation, agricultural and farmland protection, preliminary engineering, environmental stewardship and emergency management.

EXISTING IN-STATE AND OUT-OF-STATE INFRASTRUCTURE

The continued maturing of the Cloud computing industry has led many organizations to conclude that outsourcing storage and enterprise computing services offers many economic and resource management opportunities. For the State of Alaska it also raises certain challenges. The cloud is built on the internet which by and large is built on the TCP/IP stack. TCP/IP is premised on the concept wherein redundant network routing provides a means for stable communications even in light of the possibility of physical disruptions to the network. So long as there are multiple physical routes between nodes this premise is valid. The challenge arises when there is only one or two physical pathways. The concern for Alaska in particular is there are limited numbers of data centers in the State. Those which do exist seem to be single purpose with only limited redundancy and scalability. Modern Cloud data centers found in the Contiguous United States are designed with redundancy in mind. Cloud providers such as Google and Amazon as part of their business model distribute the physical placement of the datacenters and virtual machines residing therein to allow for redundancy and continuity of operations (COOP). While physical proximity to a data server does offer some advantages in throughput rates, redundancy offers advantages in stability and COOP.

There is a significant risk of internet disruption to the State if a major earthquake occurs. Alaska has the highest number of >7.0 earthquakes of any state in the United States (9) and ranks second in the United States for major earthquakes after California. Therefore, precedent exists for a physical disruption of internet services to Alaska. In such a case, the TCP/IP routing redundancy is irrelevant.

All of these points are backdrop to the question of existing infrastructure which would be applicable to the Alaska GeoPortal. There are no commercial datacenters from major Cloud providers documented to be in Alaska. There was a major state government initiative, the State of Alaska's IT Department Data Center Consolidation[1] project, which deployed a Cisco Unified Computing System and FlexPod provides one major capability to the State which is potentially flexible and scalable to meet the GeoPortal needs. The virtualized aspect of the environment is built on VMware and storage technology is provided by NetApp. The public reports suggest that the existing architecture would be viable for the State's purposes. Another potential data solution is one which has been providing similar services to the State—the University of Alaska-Fairbanks Geographic Information Network of Alaska (GINA). The current hosting services are extensive and a number of the key agencies interviewed are serving their data on the GINA currently. Finally, a number of agencies and government entities at different levels primarily host their data on other servers, whether on their own infrastructure, Federal infrastructure, or some other solution.

The factors in play are cost of hosting services, service level agreement (SLA) capabilities, the long-term sustainability of the hosting solution (*i.e.*, its plans to update the center), and COOP. The risk of a severely damaging earthquake which could disrupt communications to the contiguous United States is high enough to

[1] http://www.nascio.org/awards/nominations2012/2012/2012AK2-NASCIO%20Awards_%20State%20of%20Alaska_FINAL2.pdf

warrant a COOP strategy, and when combined with the high impact of such a disruption if the sole solution were to be in a non-Alaskan Cloud data center. Maintaining competitive costs in a government provided data center versus a cloud hosted data center could be challenging. Likewise, meeting an SLA could potentially be challenging, and Cloud service providers are well equipped to keep the agreements. In a tradeoff of all of these factors, COOP must be weighed heavily.

The basic reality is a GeoPortal and its holdings can be a form of distributed computing. There is no compelling reason to host all data or even all metadata on the same physical servers or for that matter on the same virtual servers. A system can be designed allowing for redundancy and COOP, even to the point of providing a failover for the site (*i.e.*, the web page(s) with which users interact) to another server. Given these considerations, the State should consider a hybrid approach.

In this model critical emergency response data could be hosted both in an out-of-state Cloud data center and in the State's IT infrastructure data center. Likewise the GeoPortal site could be hosted on both data center solutions, with one serving as the primary site and the other as a failover. Data which are currently hosted elsewhere could remain there, with or without redundant storage on the GeoPortal.

Requirement 12: The GeoPortal architecture should be designed with COOP in mind, particularly for emergency response data using a hybrid approach allowing for redundant out-of-state hosting.

CURRENT ALASKAN WAREHOUSING AND SERVING CAPACITY

The aforementioned State of Alaska IT Department Data Center Consolidation project provides the clearest understanding of such capacity. While other hosting services exist, their capacity to meet the criteria of the previous section (cost, SLAs, sustainability, and COOP) has not been well reported to date. The Data Center Consolidation project reported having over 200 servers each with 5.7 TB data volume capacity in place at 3 data centers in 2011 with the capacity to bring 2 new ones online per day. The project has reduced service charges by over 50%. The overall cost of $3.2M for initial implementation was well under the $5M budgeted.[2] So there is clear capacity to potentially absorb the GeoPortal within the State's infrastructure.

Alternately several other possible data centers exist and could be leveraged.

RECOMMEND STATE OF ALASKA IT REQUIREMENTS, ARCHITECTURE, EQUIPMENT, AND HARDWARE

This entire plan is intended to address this requirement. Architectural design recommendations are to be found below.

SOLUTIONS RELATIVE TO EMERGENCY SERVICES, CRISIS INTERDICTION, AND DISASTER RESPONSE

There are a number of natural and manmade hazards alluded to previously which could affect Alaska. Like most planning efforts, emergency preparedness is based on using past events to predict probable consequences of a disaster of a specified magnitude. While this method works reasonably well for assessing the known, it has

[2] http://www.nascio.org/awards/nominations2012/2012/2012AK2-NASCIO%20Awards_%20State%20of%20Alaska_FINAL2.pdf

limitations for the unknown, since such occurrences have not been observed directly (*e.g.*, a massive meteor impact such as the Arizona Meteor Crater impact). While models exist which attempt to understand the implications of such disasters, known errors in predicting actual observable conditions suggest such models not be taken as absolutely accurate, either in terms of over or under predicting damage. There exists a probability of disasters occurring at such an unprecedented scale in human observation, making it extremely difficult to predict with certainty the outcome or the capacity of human systems, including IT systems to survive or have any practical resiliency (*e.g.*, an explosive eruption of the Yellowstone Super Caldera). While we know such events are possible, based on geologic evidence, we cannot known for certain how extreme the damage of such a severe event might be. Having addressed such a possibility, this section will focus on hazards which can be understood and to which there are a predictable responses. Table 2 elaborates on this.

Table 2: Natural and Manmade Hazard Assessment

Risk	Probability	Impact	Mitigation
>7.0 magnitude earthquake	Moderate; over the past 70 years there have been 9 such earthquakes in AK; 4 of those have occurred since 2000	Moderate to extremely high; earthquake magnitude is measured by order of magnitude. An 8 is 10 times greater than a 7, so damages grow correspondingly; damage to infrastructure is probable with a higher magnitude event; loss of life and limb, power loss, structural damage, transportation and communication disruption; critical services such as hospitals are likely to be equally affected	Redundancy in all systems; redundant power to AK based data centers; redundant storage and services at different data centers; design to have partner data mirrored on GeoPortal and their sites; establish backup internet service through satellite communications
Terrorist attack on infrastructure	Low; such instances are rare and targets are selected for messaging impact; however a target may be deemed as convenient and effective by perpetrators	Moderate to High; risk of loss of life and limb, some infrastructure damage, property loss, service disruptions; however, impacts are likely to be localized; political fallout is likely to be high (however it is worth noting much of New York City's GIS capability was housed at the World Trade Center and was lost on 9/11)	Again redundancy which will allow networks to be routed around the damaged area; it will also allow for failover from a lost datacenter to another
Tsunami	Moderate; tsunamis are highly variable in scale and local conditions can enhance effects	Moderate to extremely high; the highest wave ever measured was a 1958 event in Lituya Bay, AK. However the impact was severe in the bay and surrounding area, approximately a 15 square mile area. the physical damage was extreme but localized and apparently only two lives were lost; comparatively the December 2004 tsunami led to >280,000 dead and missing and $ billions of economic loss; waves were up to 100 feet high; however damage was limited to coastal areas	Tsunamis can be quite extensive, but will tend to be constrained by topography to some degree (although topography can also exacerbate the nature of a tsunami); geographic isolation from shorelines and low elevation locations will reduce probable damage from tsunamis to critical IT data centers; again redundancy also provides a means of security for information services
Wildfire	High; wildfires occur with high frequency	For IT infrastructure the impact is low to moderate; generally such features are fire resistant; the highest risk is to wire distributed services; property and natural resource damage is high and some risk of loss of life and limb	Redundancy and mobile solutions
Solar Storm (Coronal Mass Ejection)	Low; such events are estimated to occur somewhere between 150 and 500 years and might miss Earth entirely	Extremely high; such an event would disrupt satellite systems and would cause the US damages on order of $0.6–2.6 trillion; terrestrial systems would be disrupted as well; likely loss of cellular and other wireless services; damage to wired systems is probable; power loss and disruptions to communications; loss of life as a secondary consequence	Systems hardening to resist radiation effects; paper maps; isolated and insulated archives of data and systems

As the examples in Table 2 show, COOP is best served with redundancy of systems with a distribution of data centers in areas isolated from one another. For Alaska, despite its size, including a redundant system elsewhere in the country would be advantageous. For local security, isolating archives in hardened, earthquake resistant buildings, far from shorelines would be a reasonable safety precaution. The constraint is always the financial burden of such precautions.

The minimal recommended approach is to have GeoPortal redundantly housed at all three of the State's major data centers, with a periodically updated retrieval archive located at a Cloud data center elsewhere in the country.

Requirement 13: The GeoPortal architecture should be designed with redundant solutions and archiving of data and services.

ARCHITECTURE

The following architectural recommendations for the Alaska Geo-Portal is a design which takes into account the requirements listed previously in the Requirements section. Following are four viewpoints which describe the recommended approach. The recommendation is vendor and tool agnostic. There are a number of commercial and open source solutions which could be employed to fulfill the needs. In fact, a hybrid solution using integrated components from various such sources could be put in place. The practical implementation will need to factor in cost considerations for which we have no specific data. Suffice to say, the abstract architecture presented in the following sections can be built in a cost effective manner using a variety of solution choices.

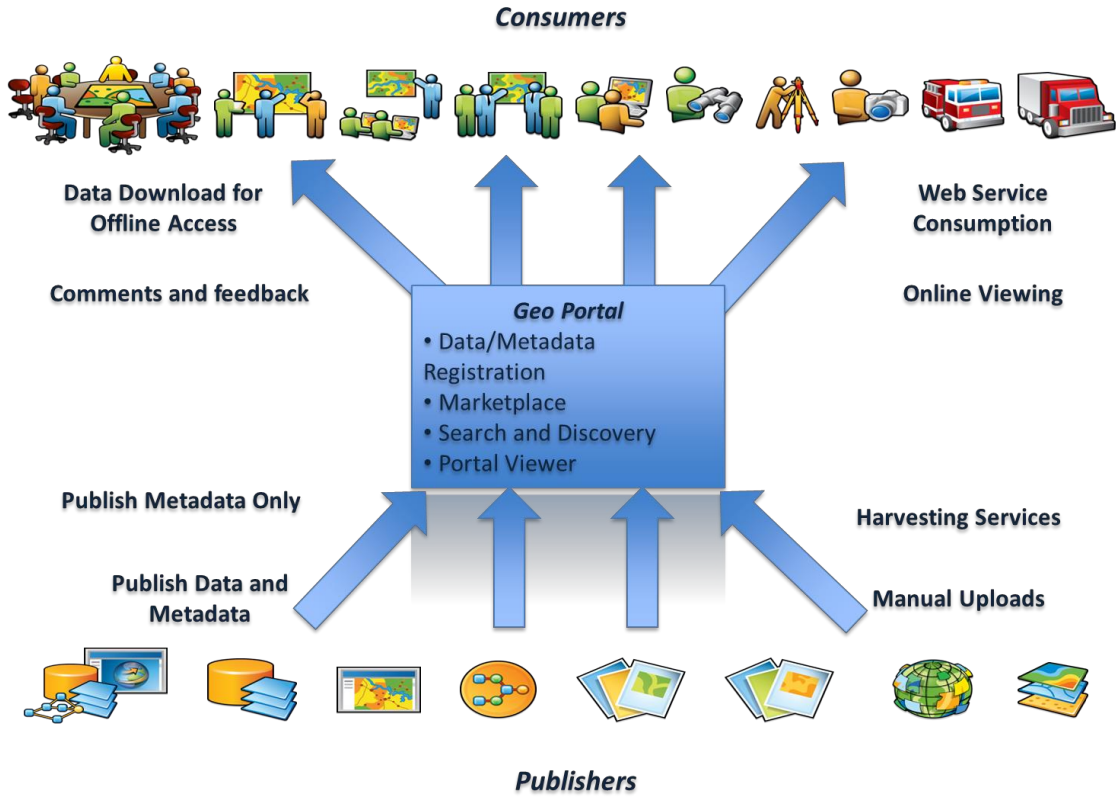

Figure 4: The GeoPortal architecture should be designed to meet the full range of user needs and requirements in a singular, extensible design

Figure 4 lays out the user perspective in light of services the GeoPortal will perform. It recognizes the user classes, and the associated services for those user classes. It also recognizes their requirements vary and allows for range within a single design which can extend across an environment that enables the use of multiple instantiations. Given the fact content is the resource of interest for all users, we will begin the discussion with Publishers and work towards Consumers.

This design infers the existence of a discrete capability which falls outside of its purview. This discrete capability is the systems and software belonging to the Publishers which are required to create the content which is being published. The range of such tools and implementations is extensive and is not an actual part of the GeoPortal, but is part of the larger ecosystem which supports the Alaska GeoPortal and other such systems.

Publishers may publish either data, metadata, or both. The requirement is the system support these three options. As stated earlier, the Publisher may choose only to publish metadata to advertise the "fact of" a dataset, or may use metadata to point to data held in another holding other than the GeoPortal (e.g., Data.Gov), or use metadata to describe published data hosted on the GeoPortal. There are two options for publishing the data and/or metadata. The first option is a manual upload initiated by the Publisher. In such an approach, the Publisher will require an account authorized to allow such upload access. The second method would be a harvesting service wherein the Publisher's data is associated with the GeoPortal and the GeoPortal automatically detects updates and uploads those on a periodic basis. In this case the Publisher would need to use service and data metadata to advertise the availability of the update and the means to obtain it.

The GeoPortal provides basic services to be a practical tool for the range of users. As stated above Publishers are able to register their data and/or metadata. The GeoPortal acts as a Marketplace which allows users access to data and services. Such Marketplace tools are either hosted or indicated by the GeoPortal. The GeoPortal provides Search and Discovery tools which allow users to create queries to find the geospatial data and/or services of interest which reside within or are accessible via the GeoPortal. Finally the GeoPortal provides a Portal Viewer that is able to show data hosted on the GeoPortal and data via services provided by Publisher infrastructure.

Consumers form the other side of the transaction. They are able to leverage the GeoPortal services described above to enable geospatial data and services. It is expected Consumers will use a variety of client technologies ranging from web-based clients to apps to thick clients to access data and services.

The design takes into account there are two major classes of Consumers. The first is the connected Consumer, meaning they have some form of reasonably responsive network connection. To be clear this range covers a range of possibilities including high speed LAN access, broadband, DSL, and 3G/4G cellular networks. The second class is the disconnected Consumer. This is understood to be an intermittent state, with period of disconnection ranging from <1 day to some extended period of time which could exceed 1 month. However, it is envisioned such a Consumer does have intermittent access as a connected Consumer, allowing them to physically download data to client machines which will be disconnected. A variation is an agent who is a connected Consumer acts on behalf of a disconnected Consumer and downloads the data to a staging medium such as a hard drive and physically transport this staging medium to the disconnected Consumer. In certain cases this transaction would be reversed and the disconnected Consumer may act as a Publisher, bringing updates to the Portal, in a process similar to that described above for manual uploads. In such cases, policies and procedures will need to be established to ensure existing Published data and related services are not disrupted or damaged.

Consumers will be able to access and leverage geospatial web services, whether hosted on the GeoPortal or on Publisher infrastructure. Likewise they will be able to view data and services via the online Portal Viewer.

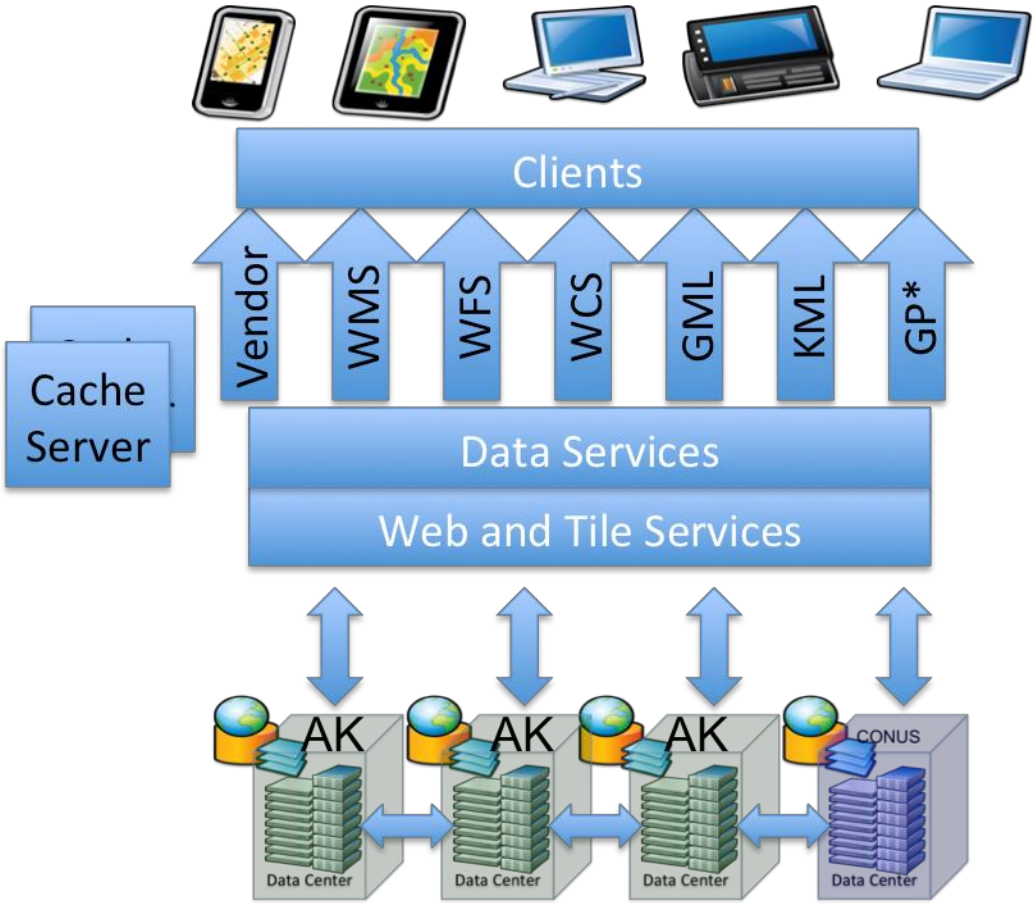

Figure 5: The GeoPortal architecture should be redundant at the Data Center level and provide a combination of web services and data provision with standard well known services and data formats such as OGC WMS, KML, and Geopackages

Physically this design envisions leveraging at least one and possibly multiple data centers in Alaska and at least one in the contiguous United States (see Figure 5). As discussed above there are available data center resources in Alaska to meet these needs. The data centers have the capacity both in terms of physical and/or virtual machines to scale up to meet potential needs for the State. Any selected datacenter will have ≥1 active GeoPortal enabled set of servers and the capacity internal to the data center to scale to multiple server sets capacity, to meet needs. Replicated versions of the GeoPortal could exist at the data centers, with one acting as the primary site, but with backup sites handling the burden if locational proximity or other factors allow it to more efficiently provide users access. Similarly if user load balancing requires, secondary sites can provide additional compute resources to distribute the required services. The GeoPortal details are shown below in Figure 7, but the capability exists at each data center, thus meeting redundancy, service level, and risk requirements. These server sets for the GeoPortal enable a number of services, including a variety of web services and supporting tiling services. Likewise these services enable data services. A cache service would be applied to increase efficiency of service and data delivery. The client machines and tools could leverage standards-based and proprietary geospatial

services. As stated this would include direct data download services via standards based encoding such as OGC *GeoPackage or via vendor specific formats.

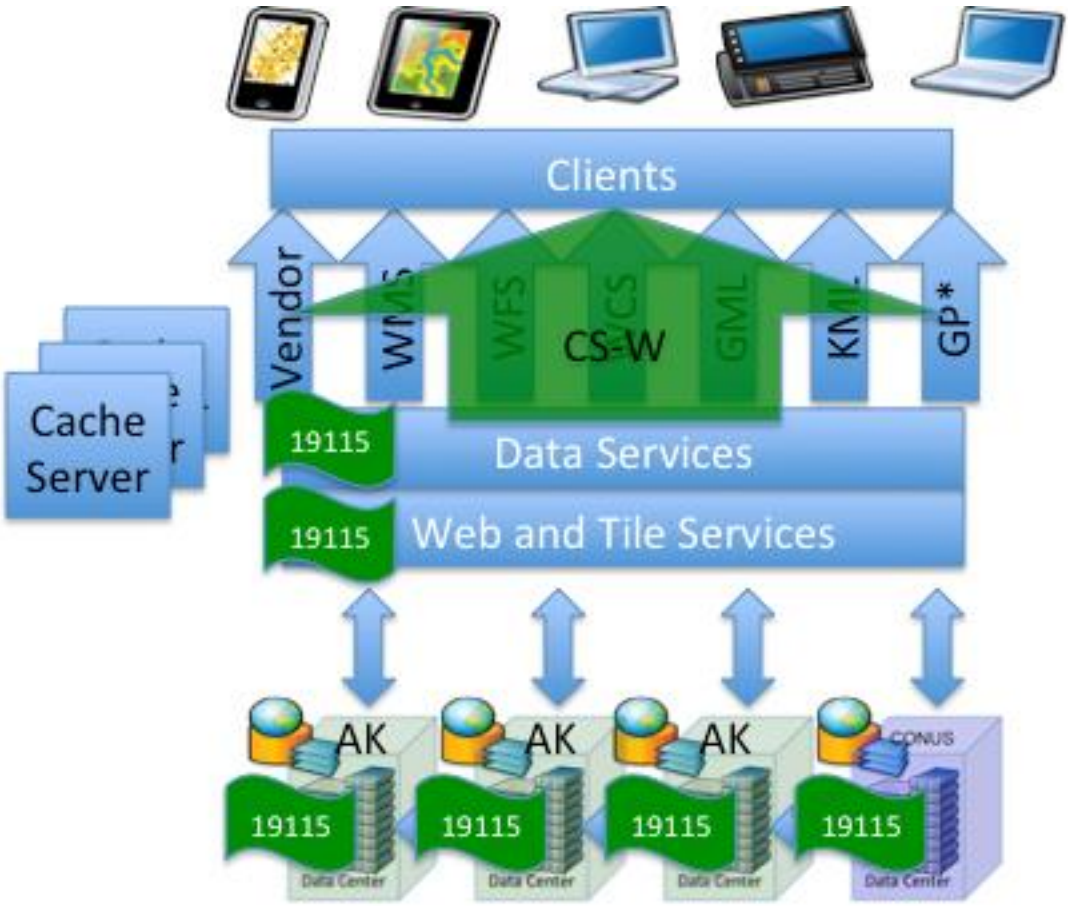

Figure 6: The GeoPortal should leverage ISO 19115 metadata and OGC Catalog for Web Services (CWS) to provide data and service discovery

There is a detailed discussion pertaining to metadata below, but for now the design presumes an adoption of the ISO 19115 metadata standards. In this design 19115-based metadata can be used to describe geospatial data at various levels including a subset of a particular geospatial database or an entire collection. For example, the entire GeoPortal could have a 19115 metadata description. To publish such services in machine readable format, ISO 19139 is leveraged to encode the 19115 metadata, which can then be advertised via OGC Catalog Services for Web (CS-W). This enables the discovery of the various geospatial web services and their associated data.

Again there is an inference similar services exist on Publisher infrastructure, when the Publisher choose to host their own data. Hypothetically, the GeoPortal could serve as a source of geospatial web services to other portals hosted by other entities. In such a case, the external portal would be able to discover geospatial web services and data hosted on the Alaska GeoPortal and either re-host or point to the original GeoPortal capabilities. The design allows the GeoPortal to exist both independently and as a cooperative partner in a greater community of geospatial service providers.

Clients are able to access the CW-S and discover the delineated geospatial services and use them in a manner appropriate to their capabilities. So a range of physical devices and associated software can leverage this design.

Looking at the design from a services perspective allows further understanding of the components and how they work together (see Figure 7).

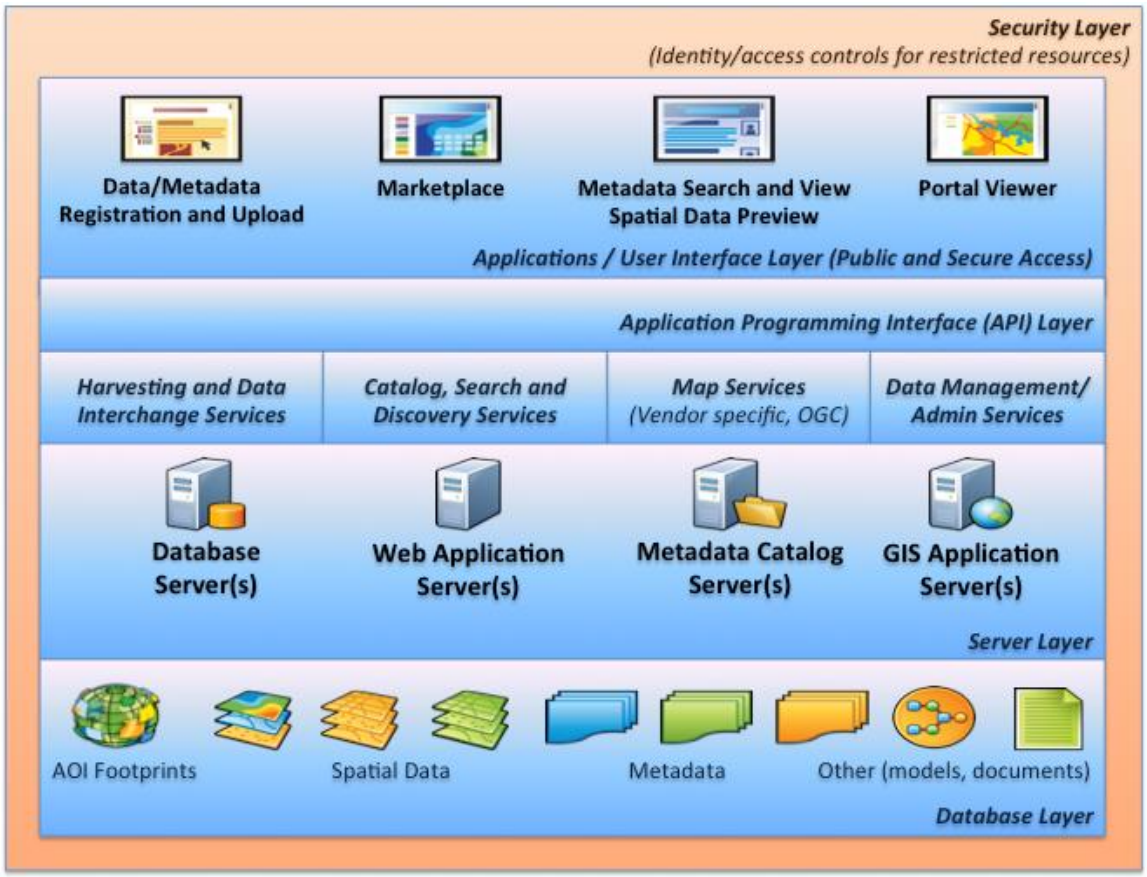

Figure 7: The design places the architecture and its services in a layered approach that is proven and efficient.

Beginning with the database layer, a number of data types can be hosted including spatial data and metadata, but also other forms of data including models and documents which can be associated down to specific map features. These are hosted on a set of servers (either physical or virtual) including the Database Server(s), Web Application Server(s), Metadata Catalog Server(s) and GIS Application Server(s). Again the physical aspect of this design is replicated at multiple data centers. Next in the stack is an Application Programming Interface (API) layer allowing for the enablement of the particular referenced services such as Harvesting and Data Interchange Services; Catalog, Search, and Discovery Services; Map Services whether OGC standard services, vendor or open source specific services; and finally Data Management/Admin Services allowing the maintenance and management of the GeoPortal.

The layer most users will engage is the Applications/User Interface Layer which will enable both public and secure access to GeoPortal services and data. Both Publishers and Consumers would interact with the layer. Publishers would have secure access tools for geospatial data and/or metadata registration and upload. Consumers would be able to leverage the Marketplace, Metadata Search and View/Spatial Data Preview, and the Portal View services.

Surrounding all of this is a Security Layer. The design calls for multiple levels of security (identification and authentication). For "open" resources (data and metadata) on the GeoPortal, these resources can either be accessed with no security whatsoever or alternately, Alaska may wish to at least require users to identify themselves (register) before downloading data. For sensitive resources, the next layer of identification and authentication might be enabled via HTTP-based credentials (username/password entered on the site then passed to the Portal app components and APIs). Another approach would be structured so the next layer of identification and authentication could be more robust security protocols including token-based credentials or client certificates (such as x.509 and certification authority [Verisign, etc.]) validation. In all cases, the Portal should use data encrypting via HTTPS/Secure Sockets Layer (SSL). This is design which recommends the Portal be as "open" as possible, to maximize use and to offer access to the widest stakeholder audience possible. Sensitive data resources might be published to the Portal as metadata only, and then stakeholders wishing to access those data can contact the publishing organization directly, once the publishing organization validates the request.

METADATA IMPLEMENTATION AND MIGRATION

The Federal Geographic Data Committee has endorsed ISO 19115 which pertains to geospatial metadata in particular, and derivative standards. There are associated standards which will need to be used by the GeoPortal. The list of FGDC endorsed standards pertinent to this project include specifically:

- ISO 19115:2003 Geographic information – Metadata (corrigendum 1): The base ISO metadata standard for the description of geographic information and services. Expected to be replaced by ISO 19115-1: Geographic Information – Metadata – Part 1: Fundamentals once approved by ISO (currently a Draft International Standard, anticipated to be an International Standard in May 2013)3.
- ISO 19115 – 2: Geographic information - Metadata - Part 2: Extensions for imagery and gridded data The base ISO 19115 metadata standard plus extended elements for the description of imagery, gridded data and data collected using instruments, e.g. monitoring stations and measurement devices. These extensions also include improved descriptions of lineage and processing information. ISO 19115-2 is expected to be updated to comply with ISO 19115-1 once the final standard is released.
- North American Profile (NAP) of ISO 19115: A US and Canada joint profile of ISO 19115:2003 that extends some domains, increases conditionality for some elements, and specifies best practices for populating most elements.
- ISO 19110: Geographic information – Methodology for Feature Cataloging: An affiliate standard that supports the detailed description of feature types (roads, rivers, classes, rankings, measurements, etc.) in a manner similar to the CSDGM Entity/Attribute Section. The standard can be used in conjunction with ISO 19115 to document geospatial data set feature types or independently to document data models or other feature class representations.

[3] This is quoted from the FGDC website. According to ISO, ISO 19115:2003 has been revised by: ISO 19115-1:2014.

- ISO 19119: Geographic information - Services - Amendment 1: Extensions of the service metadata model. An affiliate standard that supports the detailed description of digital geospatial services including geospatial data portals, web mapping applications, data models and online data processing services. The standard can be used in conjunction with ISO 19115 to document services associated with a specific data set/series or independently to document a service.
- ISO 19139: Geographic information -- Metadata -- XML schema implementation: An XML document that specifies the format and general content of an ISO 19115 the metadata record. Expected to be updated to ISO 19115-1: Geographic Information – Metadata – Part 1: Fundamentals once approved by ISO.

Various tools have created to migrate FGDC Content Standard for Digital Geospatial Metadata (CSDGM) to ISO 19115 compliant metadata. One example is ArcCatalog 10.x. These tools take CSDGM content and convert it to 19115.

We believe ISO 19115 and its related standards will become the norm and CSDGM will eventually be deprecated in its favor. While many organizations indicated an unwillingness to migrate off CSDGM, it is probable market pressures will push them to do so. Our design can accommodate either standard, but given the likely outcome, we recommend proceeding directly to an ISO 19115 implementation.

APPENDIX: ALASKA SDMI GEO-PORTAL AND METADATA REGISTRY TASK ORDER REQUEST

TASK ORDER DETAIL

USGS CONTRACT: G10PC00013

CONTRACTOR: DEWBERRY

TASK ORDER NUMBER: G14PD00310

TASK NAME: Alaska SDMI Geo-Portal and Metadata Registry

The Contractor shall furnish all facilities, labor, materials, and equipment, unless specifically identified otherwise, to provide the mapping services and products in accordance with the specifications, terms, and conditions contained in Contract No. **G10PC00013**, and the following requirements specific to this Task Order, and in accordance with Contractor's proposal dated _____, 2014, and in the amount of:

Task Order Fixed Price	**$**

SECTION C: DESCRIPTION/SPECIFICATIONS/WORK STATEMENT.

The following **Section C** additional requirements are applicable to this Task Order:

C.1. **Statement of Work (SOW)**: Potentially, many millions of dollars' worth of publicly funded Alaska geospatial data is inadequately catalogued or unavailable to users because a single, authoritative, central intergovernmental clearinghouse or registry is in adequate and sustainability is in question. In 2010, the Alaska Statewide Digital Mapping Initiative (SDMI) led to the successful development and adoption of both a Geospatial Strategic Plan and a Geospatial Business Plan for the advancement of geospatial policy in Alaska. User input is critical to the successful development of a sustainable, one-stop Geospatial and Metadata Registry Portal to efficiently warehouse and distribute geographic data. The scope of this task is designed to engage users and encourage objective and open dialogue in an effort to clarify and define Geo-Portal and Metadata Registry functionality and requirements through workshops and online survey(s). In conjunction, a basic online learning tool shall be developed to introduce the (International Standards Organization (ISO) metadata standard and associated benefits as related to geographic information. This online learning tool shall be sufficient to provide a tutorial or introductory training to encourage and enable stakeholders to adopt and implement the ISO metadata standard. Contractor shall provide sound recommendations to efficiently convert existing metadata to ISO standards for ingestion into the Geo-Portal and Metadata Registry warehouse for public distribution.

C.1.a. **KICK-OFF MEETING:** A kick-off meeting shall be held to outline communication procedures that shall be followed with respect to technical communications and information exchange. This meeting shall be used as a forum to seek related clarifications and resolve issues of a technical nature. The kick-off meeting shall be held no later than **two (2) weeks** after contract award and prior to onset of work.

C.1.b. **PHASE I - PRE-DISCOVERY**

Contractor shall conduct a broadly-applied online survey targeting GIS users across all lines of business, all levels of government (i.e., state, federal, local, tribal), military, academia and public entities and shall also include private for profit and private not for profit organizations. Contractor shall complete the following tasks:

C.1.b.(i) Develop and recommend a failure proof online survey method to include strategic questions for the purpose of identifying Geo-Portal and Metadata Registry functionality and user requirements.

C.1.b.(ii) Develop a comprehensive e-mail list of GIS stakeholders to participate in the survey(s).

C.1.b.(iii) Methodically poll GIS stakeholders for input while preventing individual duplicate survey responses.

C.1.b.(iv) Tabulate survey responses prior to Phase II efforts and report findings to the evaluation team.

C.1.b.(v) Create a basic online ISO metadata educational and training tool that the State of Alaska can host for stakeholder access. This tool shall provide a basic understanding of ISO metadata benefits as they relate to geographic information. This tool shall provide a tutorial sufficient to encourage and enable stakeholders to adopt and implement the ISO metadata standard.

C.1.b.(vi) Provide sound recommendations to efficiently convert existing metadata to ISO standards for ingestion into the overarching distribution system for public consumption through efficient, effective and reliable means.

C.1.b.(vii) Review State of Alaska infrastructure and Information Technology (IT) resources, State emergency response capabilities and needs and point to point connectivity.

C.1.b.(viii) Provide recommendations for development and implementation of the Geo-Portal using State assets, contract services, or a hybrid solution using a combination of State assets and contracted services.

C.1.c. **PHASE II - STAKEHOLDER MEETINGS and INTERVIEWS**

Contractor shall conduct three (3) meetings or workshops for the purposes of stakeholder outreach, to present survey results, seek participant

comments, and build consensus. A single half-day outreach meeting or workshop shall be held in Anchorage, Alaska. Contractor shall also conduct two (2) web-based meetings targeting stakeholders who are unable to attend the location-based meeting in Anchorage. Contractor shall conduct a minimum of sixteen (16) one-on-one, independent interviews with key stakeholders as identified by the State of Alaska. Interviews may be conducted in person or by telephone. Contractor will be reimbursed for actual travel expenses in accordance with state travel policy. Travel to and from the state; accommodations in state; vehicle rental and in state air travel will be reimbursed at prescribed Alaska state travel rates. This information is available online at *http://doa.alaska.gov/dof/manuals/aam/resource/60t.pdf*. Contractor shall perform the following tasks.

C.1.c.(i) Review historical documents of significance to include the Alaska Geospatial Strategic and Business Plans. Also to include billings, contractual agreements and/or anything relative to existing data/archival and distribution services.

C.1.c.(ii) Coordinate all logistics, invitations and support functions for all stakeholder meetings to include one half-day meeting and two (2) web based meetings to include all activities from set up to clean up.

C.1.c.(iii) Draft regional stakeholder meeting invitations to include the half-day meeting and the web forums and provide to the steering committee for review.

C.1.c.(iv) Draft agenda to be used at each regional stakeholder meeting including scripting of the forum, introductions, special guests and facilitator questions and provide to the steering committee for review.

C.1.c.(v) Conduct Stakeholder Meetings.

C.1.c.(vi) Provide report summarizing all stakeholder findings.

C.1.c.(vii) Develop list of questions for steering committee approval. These questions will be used to interview the key officials and leaders that are identified by the steering committee.

C.1.c.(viii) Conduct one-on-one independent interviews with key officials and leaders.

C.1.d. **PHASE III – GEO-PORTAL and METADATA REGISTRY PLAN and ISO LEARNING TOOL**

Contractor shall draft a Geo-Portal and Metadata Registry Plan and shall document facts and findings for review by the steering committee or evaluation team. Contractor shall also prepare and deliver an ISO learning tool that will be used to educate and train stakeholders regarding ISO metadata. Contractor shall perform the following tasks and subtasks in completing this phase.

C.1.d.(i) Provide draft Geo-Portal and Metadata Registry Plan for review, input and acceptance by evaluation team. Sub-activities shall include:

C.1.d.(i)(a) Assess connectivity issues for rural or remote areas where download of large files is difficult and recommend options or solutions.

C.1.d.(i)(b) Assess and report on *all options* relative to long term sustainability regarding the funding of the Geo-Portal.

C.1.d.(i)(c) Assess and document options for sustainable no-fee access to public domain geospatial data.

C.1.d.(i)(d) Provide recommendations on restriction of non-public data through authentication or other measures to protect limited use licensing products from irresponsible or unnecessary exploitation.

C.1.d.(i)(e) Define method to best identify datasets for State license uplifts to control and or limit spending in the event it may be more cost effective to uplift an existing dataset.

C.1.d.(i)(f) Clearly define potential statewide licensing policy and procedure to acquire public domain licensed data, sunset clauses or other best practices for acquisition of geospatial data

C.1.d.(i)(g) Assess and report on existing in-state (Alaska) and out-of-state infrastructure, capabilities and resources related to geospatial data distribution as relevant to construct of an authoritative Geo-Portal for the State of Alaska.

C.1.d.(i)(h) Document current warehousing and serving capacity and capability within Alaska and publish historical and or existing SDMI contracts and cost structure for said services

C.1.d.(i)(i) Assess and recommend State of Alaska sponsored IT requirements, architecture, equipment and hardware to most efficiently establish, maintain and operate a highly functional and accessible data warehouse that is capable of effective data stewardship, custodianship and distribution services.

C.1.d.(i)(j) Consider and propose solutions relative to emergency services, crisis interdiction and disaster response. Proposed solutions shall detail the construct of a system designed with high reliability throughout natural and manmade disasters probable in Alaska and shall benefit first responders and emergency management. Considerations shall include system interactions and dependencies upon data stewardship, distribution and connectivity issues during power outages, terrestrial and space based telecommunication outages and other challenges associates with wide-spread and massive disaster scenarios. Contractor shall recommend responsible and cost-effective stand-alone options for evaluation by emergency management executives. Solutions shall detail architecture, operations and maintenance costs. A Geo-Portal recommendation that does not consider these requirements is NOT acceptable.

C.1.d.(ii) Host approved draft Geo-Portal and Metadata Registry Plan online for stakeholder input. Content shall be available for a minimum of two weeks to solicit review and stakeholder comment. Contractor shall immediately notify all online all known stakeholders identified during the pre-discovery phase upon document upload.

C.1.d.(iii) Provide final plan and documentation after stakeholder review and input.

C.1.d.(iv) Deliver four (4) electronic versions of the online ISO Metadata Educational and Training Tool.

C.1.e. **DELIVERABLE PRODUCTS -**The following deliverable products shall be produced as specified in Section C.1.b above.

C.1.e.(i) **Kick-off Meeting:** Contractor shall attend Kick-off Meeting with Steering Committee to outline procedures that shall be followed with respect to technical communications and information exchange.

C.1.e.(ii) **Survey Tool and Survey Questionnaire.** Contractor shall develop an online survey questionnaire targeting GIS users across all business lines, state, federal, local, public, tribal, private for profit and private not for profit, military and academia. The survey method shall be fail-proof and the appropriate survey tool shall be at the discretion of the Contractor.

C.1.e.(iii) **Comprehensive GIS Stakeholders List for Survey.** Contractor shall provide a comprehensive e-mail list of stakeholder participants. This list shall be provided in electronic format.

C.1.e.(iv) **Documented Survey Responses and Findings Report:** Documented survey responses and associated recommendations shall be delivered in tabular format (Excel is preferred). Contractor shall **provide ten (10) hardbound copies and three (3) electronic copies**.

C.1.e.(v) **DRAFT Stakeholder Meeting Agenda and Invitations:** Contractor shall submit draft stakeholder meeting invitations and agenda for review and approval by the steering committee.

C.1.e.(vi) **FINAL Stakeholder Meeting Agenda and Invitations:** Contractor shall provide final stakeholder meeting invitations and agenda for review and approval by the steering committee **within 3 business days** of approval of the draft agenda and invitations.

C.1.e.(vii) **Stakeholder Meetings**: Three (3) meetings or workshops shall be held to build consensus among stakeholders and shall include coordination, all logistics, invitations and all support functions to include set-up and

clean-up. One meeting shall be held at a location to be determined in Anchorage, AK and two meetings shall be web-based.

C.1.e.(viii) **Key Officials and Leaders Questionnaire:** Contractor shall develop a list of interview questions for steering committee approval.

C.1.e.(ix) **Key Official and Leader Interviews:** Contractor shall interview a minimum of 16 officials as identified by the State of Alaska. Contractor shall develop a list of interview questions for steering committee approval.

C.1.e.(x) **Stakeholder Findings Report:** Contractor shall prepare and deliver a report summarizing all stakeholder findings. Final report shall be delivered in three (3) hardcopies, MS Word format. Electronic copy shall be provided for distribution to the Steering Committee.

C.1.e.(xi) **Draft Geo-Portal and Metadata Registry Plan:** Contractor shall host a steering committee approved Geo-Portal and Metadata Registry Plan online for stakeholder input. Contractor shall notify all stakeholders immediately upon plan upload. Content shall be available for a minimum of two weeks.

C.1.e.(xii) **Final Geo-Portal and Metadata Registry Plan:** Contractor shall provide the final plan and documentation in ten (10) hard copies and one (1) electronic copy for distribution to the Steering Committee.

C.1.e.(xiii) **ISO Metadata Educational and Training Tool:** Contractor shall develop and deliver **four (4) electronic versions** of an online Metadata Educational and Training Tool.

C.1.f. **USE AND DISTRIBUTION RIGHTS:** These findings shall be free from restrictions regarding use and distribution. In any such publication the USGS will acknowledge Contractor as the source of the study data.

C.1.g. **CERTIFICATIONS:** The contractor shall certify as part of its proposal that the work performed on this task order complies with Section 52.225-05 of the Federal Acquisition Regulations relating to Trade Agreements.

C.1.h. **THE GOVERNMENT POINT-OF-CONTACT (POC)** FOR THIS TASK ORDER: The Government Point of Contact for this task order and any modifications shall be the POC listed below.

Address: USGS-NGTOC
ATTN: Gail Dunn, MS 663
1400 Independence Road
Rolla, MO 6540

Telephone: (573) 308-3756
FAX: (573) 308-3810
E-mail: gdunn@usgs.gov

C.2. **Digital Deliverables**: Reference C.1 of the Contract.

C.2.a. **The Contractor shall deliver** the data products and documentation as specified in Section C.1 of this Task Order.

C.2.b. **Format:** Data shall be delivered in the formats specified in C.1.c above.

C.2.c. **Delivery Medium:** The digital data shall be delivered on CD-ROM, DVD or PC compatible external hard drive, i.e. (firewire, or USB2 – Less than USB2 is not acceptable). Files shall be stored into appropriate directories on the drive.

SECTION D: - PACKAGING AND MARKING

D.1. No additional Section D requirements are applicable to this Task Order.

SECTION E: - INSPECTION AND ACCEPTANCE - The following Section E additional requirements are applicable to this Task Order:

E.1. **Inspection Period:** Reference GS0720 of the Contract. The inspection period begins the day after the data has been delivered. All deliverables will be validated within a **ten (10) business days**.

E.2. **Inspection and Acceptance Procedures:** ReferenceE780 of the Contract. The Government will perform a full inspection of all deliverables in accordance with E780 (b) of the Contract.

E.3. **Nonconforming deliverables:** Nonconforming deliverables returned to contractor for rework shall be delivered in accordance with Contract clause E784 (b). **Rework shall be delivered within ten (10) calendar days.**

SECTION F: - DELIVERIES OR PERFORMANCE - The following Section F additional requirements are applicable to this Task Order:

F.1. **Place of Delivery:** Reference GS0904 of the Contract. Contractor shall submit all requested deliverables to the address of the POC, as shown in Section C of this Task Order.

F.2. **Delivery Schedule:** Reference F981 of the Contract. The Government requires the following delivery schedule:

F.2.a. **Lot One (1): Kick-off Meeting** shall be held no later than **seven (7) calendar days** after contract award and prior to data production, but not later than **April 4, 2014.**

F.2.b. **Lot Two (2): Comprehensive GIS Stakeholders List** shall be delivered not later than **April 18, 2014.**

F.2.c. **Lot Three (3): On-line Survey Tool** shall be selected and **Questionnaire** shall be developed and implemented no later than **fifteen business days** after the Kick-off Meeting, but not later than **April 21, 2014.**

F.2.d. **Lot Four (4): DRAFT Stakeholder Agenda and Invitations** shall be delivered not later than **May 14, 2014.**

F.2.e. **Lot Five (5): FINAL Stakeholder Agenda and Invitations** shall be delivered no later than two (2) business days after Steering Committee approval, but not later than **May 16, 2014.**

F.2.f. **Lot Six (6): Documented Survey Response Report** shall be compiled and delivered not later than **May 30, 2014.**

F.2.g. **Lot Seven (7): Stakeholder Meetings** shall be held beginning not later than **June 1, 2014** and shall conclude not later than **June 30, 2014.**

F.2.h. **Lot Eight (8): Key Official and Leader Questionnaire and Interviews:** Contractor shall deliver questionnaire for Steering Committee approval not later than **July 7, 2014** and shall administer and conclude interviews not later than **August 1, 2014**.

F.2.i. **Lot Nine (9): Stakeholder Findings Report** shall be delivered not later than **August 15, 2014.**

F.2.j. **Lot Ten (10): Draft Geo-Portal and Metadata Registry Plan** shall be delivered to the Steering Committee within **120 calendar days** of the Kick-off Meeting, but in no case later than **August 29, 2014**.

F.2.k. **Lot Eleven (11):** Publish **Online Draft Geo-Portal and Metadata Registry Plan** within **ten (10) business days** of Steering Committee feedback, **but no later than September 8, 2014**.

F.2.l. **Lot Twelve (12): Final Geo-Portal and Metadata Registry Plan and ISO Metadata Educational Tool** as specified in the task order shall be delivered no later than **ten (10) business days** following Government acceptance of the Draft Deliverables, but in no case later than **October 1, 2014**.

F.3. **Progress Reports:** Contractor shall submit a monthly progress report for this task order in accordance with Contract clause GS0921 and GS0931.

SECTION G: - CONTRACT ADMINISTRATION DATA

G.1. No additional Section G requirements are applicable to this Task Order

SECTION H: - SPECIAL CONTRACT REQUIREMENTS –

The following Section H additional requirements are applicable to this Task Order:

H.1. **Government Furnished Property:** Reference H1480 (Conditions Regarding Use of GFP) of the contract. No Government furnished information or property is being supplied with this Task Order.

H.2. **Return of GFP:** Upon project completion, the Contractor shall destroy all copies of the GFP and **shall not retain a copy** on any of their computer systems.

SECTION I: - CONTRACT CLAUSES

I.1. No additional detail is required for this Task Order.

SECTION J: - LIST OF ATTACHMENTS TO THIS TASK ORDER

J.1. Attachments - None